DIF HAB-FS PROJECTS - BACKGROUND

- Projects are based on the existing operational system for the Eastern Gulf of Mexico – Harmful Algal Bloom Forecast System (HAB-FS)
- existing HAB-FS output is in the form of a HAB Forecast Bulletin:
  - contains an operational forecast of bloom extent, transport, intensification, and impact over 0-3 days;
  - analysts consider winds but not surface currents when forecasting a bloom's transport;
  - is used by local decision makers and the general public to inform regional public health and safety decisions
- Two separate DIF customer projects to improve HAB forecasting

HAB-FS PROJECT PHASES

- **Phase 1 - Integration of surface currents to operational bulletin software**
  - Ingest surface currents data from CO-OPS and NDBC into existing HAB-FS bulletin software using data standards and protocols adopted by the DIF
  - Resulted in reliable access to integrated surface currents data served by NDBC and CO-OPS, and ingestion and display of that data into the operational HAB-FS bulletin generation application
- **Phase 2 – Integration of modeled currents into enhanced transport model**
  - Modeled currents from CSDL are ingested into a spatially-articulated transport model (not currently in use in the operational HABS-FS) to enhance the HABS-FS.
  - Attempts to provide graphical forecast of HAB transport and northern/southern extent.

HAB-FS PROJECT COLLABORATION

Phase 1:

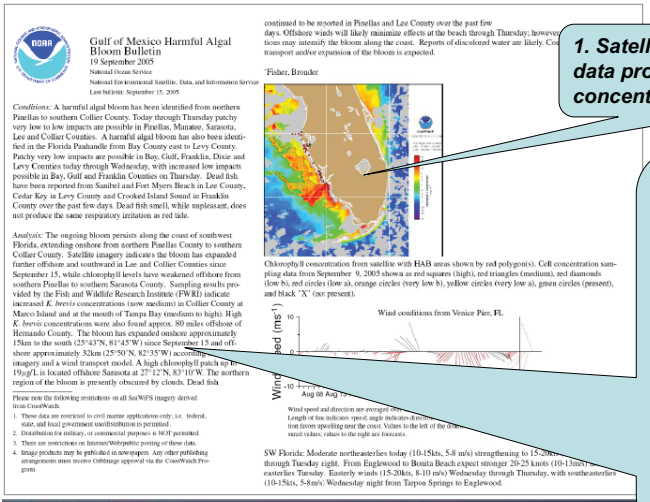
- IOOS DIF team;
- National Centers for Coastal Ocean Science (NCCOS) / Center for Coastal Monitoring and Assessment (CCMA);
- Center for Operational Oceanographic Products and Services (CO-OPS);
- Coastal Services Center (CSC)

Phase 2:

- IOOS DIF team;
- NCCOS / CCMA;
- Office of Coast Survey (OCS) / Coast Survey Development Lab (CSDL)

HAB-FS PROJECT DESCRIPTION

Existing Operational HAB-FS Bulletin:



Gulf of Mexico Harmful Algal Bloom Bulletin
19 September 2005
National Ocean Service
National Environmental Satellite, Data, and Information Service
Last bulletin: September 15, 2005

Conditions: A harmful algal bloom has been identified from northern Pinellas to southern Collier County. Today through Thursday patchy very low to low impacts are possible in Pinellas, Manatee, Sarasota, Lee and Collier Counties. A harmful algal bloom has also been identified in the Florida Panhandle from Bay County east to Levy County. Patchy very low impacts are possible in Bay, Gulf, Franklin, Dixie and Levy Counties today through Wednesday, with increased low impacts possible in Bay, Gulf and Franklin Counties on Thursday. Dead fish have been reported from Sanibel and Fort Myers Beach in Lee County, Cedar Key in Levy County and Crooked Island Sound in Franklin County over the past few days. Dead fish smell, while unpleasant, does not produce the same respiratory irritation as red tide.

Analysis: The ongoing bloom persists along the coast of southwest Florida, extending onshore from northern Pinellas County to southern Collier County. Satellite imagery indicates the bloom has expanded further offshore and southward in Lee and Collier Counties since September 15, while chlorophyll levels have weakened offshore from southern Pinellas to southern Sarasota County. Sampling results provided by the Fish and Wildlife Research Institute (FWRI) indicate increased *K. brevis* concentrations (now medium) in Collier County at Marco Island and at the mouth of Tampa Bay (medium to high). High *K. brevis* concentrations were also found approx. 80 miles offshore of Hernando County. The bloom has expanded onshore approximately 15km to the south (25°43'N, 81°45'W) since September 15 and offshore approximately 32km (25°50'N, 82°35'W) according to imagery and a wind transport model. A high chlorophyll patch up to 19μg/L is located offshore Sarasota at 27°12'N, 83°10'W. The northern region of the bloom is presently obscured by clouds. Dead fish

Please note the following restrictions on all SeaWiFS imagery derived from CoastWatch.

1. These data are restricted to civil marine applications-only; i.e. federal, state, and local government use/distribution is permitted.
2. Distribution for military, or commercial purposes is NOT permitted.
3. There are restrictions on Internet/Web/public posting of these data.
4. Image products may be published in newspapers. Any other publishing arrangements must receive Oubrange approval via the CoastWatch Program.

continued to be reported in Pinellas and Lee County over the past few days. Offshore winds will likely minimize effects at the beach through Thursday, however, tides may intensify the bloom along the coast. Reports of discolored water are likely. Continued transport and/or expansion of the bloom is expected.

Fisher, Brouder

Chlorophyll concentration from satellite with HAB areas shown by red polygon(s). Cell concentration sampling data from September 9, 2005 shown as red squares (high), red triangles (medium), red diamonds (low b), red circles (low a), orange circles (very low b), yellow circles (very low a), green circles (present), and black "X" (no present).

Wind conditions from Venice Pier, FL

Wind speed and direction are averaged over
Length of line indicates speed; angle indicates direction taken upwelling near the coast. Values to the left of the
minal values; values to the right are forecasts.

SW Florida: Moderate northeasterlies today (10-15kts, 5-8 m/s) strengthening to 15-20kts through Tuesday night. From Englewood to Bonita Beach expect stronger 20-25 knots (10-13m/s) easterlies Tuesday. Easterly winds (15-20kts, 8-10 m/s) Wednesday through Thursday, with southeasterlies (10-15kts, 5-8m/s) Wednesday night from Tarpon Springs to Englewood.

1. Satellite imagery and sampling data provide chlorophyll concentration

2. HAB Forecast is textual and based on analysts' assimilation of available data:

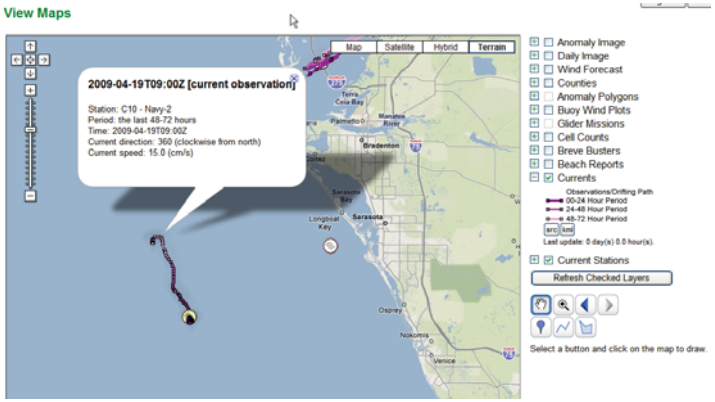
"Today through Thursday patchy very low to low impacts are possible in Pinellas, Manatee, Sarasota…counties."

"Continued southern transport and/or expansion of the bloom is expected."

HAB-FS PHASE 1

Web-based HAB-OFS Bulletin Software

HAB-FS PHASE 1



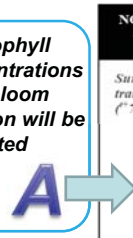
Current observations in the last three days (72 hours). Observations are divided into three time periods, including 00-24, 24-48, 48-72 hours. Three virtual drifting paths are calculated from the observations of current direction and speed. All station icons, drifting paths, and observations (displayed along the virtual drifting paths) are clickable. Currents data are obtained through NDBC and CO-OPS' web services.

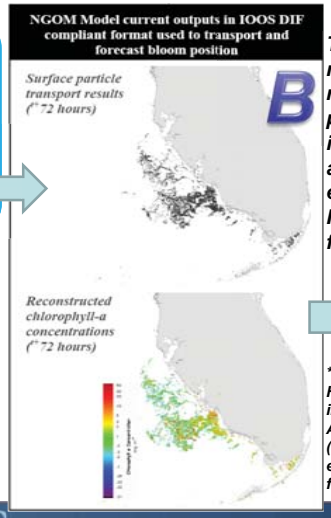
Data source (XML): NDBC :: CO-OPS
Overlay layer (KML): Current stations, virtual drifting paths, and observations

HAB-FS PHASE 2

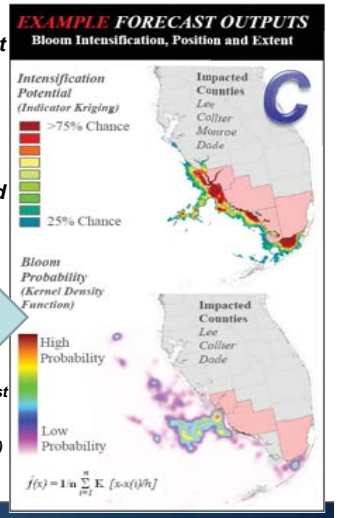
DIF Enhanced HAB Forecast :

Chlorophyll concentrations from bloom polygon will be extracted



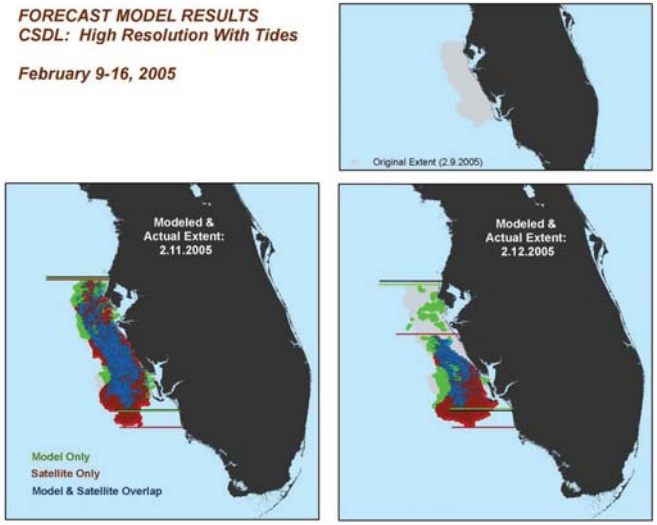


Transport model results provide input to an enhanced HAB forecast*



****Enhanced HAB forecast intended to AUGMENT (not replace) existing forecasts***

HAB-FS Phase 2 OUTPUT



HAB-FS PHASE 2 POTENTIAL BENEFITS

- ❑ Development of a probability based, spatially-articulated bloom transport and extent estimate
- ❑ A measurable increase in the spatial and temporal accuracy (skill) and precision (reproducibility) of HAB forecasts
- ❑ Extension of forecast temporal range from 3 days to 5 days and more
- ❑ Increased HAB forecast objectivity

HAB-FS PROJECT STATUS

Phase 1 (ended):

- in-situ currents observations provided by IOOS are now being ingested into the HAB-OFS bulletin software, and then displayed visually for bloom analysis in the HAB-FS software using an integrated Google Maps application;
- analysts use the IOOS currents data to analyze the potential transport and extent of a confirmed or potential harmful algal bloom over the past 72 hours when remote sensing chlorophyll data is unavailable for any reason
- analysts use the currents data in conjunction with the marine forecasted winds to form a nowcast prediction of the relative direction the bloom may have transported in over the past 72 hours.
- transport and intensification nowcasts are included in the bulletin analysis text in order to give coastal resource managers an idea of the bloom possible location and intensification.

While the currents data allows the analysts to better form a nowcast prediction for blooms, this can only be done if a bloom is located in the vicinity of a currents station.

HAB-FS PROJECT STATUS

Phase 2 (in progress):

- NDFD Wind forecast data and HF Radar Currents observation data have been excluded due to the limited funding, resources and data availability.
- Historical blooms have been reviewed, time periods for the hindcast analysis have been selected, and corresponding satellite imagery collected.
- Benchmark metrics and baseline have been identified
- CSDL team has generated the modeled currents data sets using the ROMS high-res model.
- NCCOS CCMA team ran simulations in GNOME particle tracker coupling the output from CSDL's hydrodynamic model and the derived remotely sensed image product for the selected bloom events.
- The results of the transport model runs are being processed, and the report is being compiled. The report delivery is due by the end of Sep. 2009. However, due to some modeling problems, the skill assessment and report may be slightly delayed.

HAB-FS PROJECT CHALLENGES AND LESSONS LEARNED

- ❑ Wind forecast data and HF Radar Currents observation data were not available for the selected historical blooms.
- ❑ Several time gaps were identified in the wind data inputs for the high-res currents model. The gaps partially overlapped periods of the selected blooms, and thus harmed the GNOME simulations.
- ❑ Some test runs of the GNOME model indicated that currents may be less important than winds for HAB move and expansion.
- ❑ The high-res currents model has polygon boundary limitations, which cripple the capability of the transport model to adequately predict bloom trajectory, and presents limitations in performing robust statistical analysis.
- ❑ The scope of GNOME runs has moved from simple tracking the bloom spot center of mass to more sophisticated methods of tracking the bloom edges.
- ❑ A physical nature of the GNOME model does not allow taking into account biological aspects of HAB development.
- ❑ Some techniques that were tested in this project have already been used in HAB-FS development at Lake Erie and showed certain level of success.

HAB-FS PROJECT NEXT STEPS/ RECOMMENDATIONS

It seems to be premature to make conclusions and recommendation based just on preliminary results of limited GNOME runs.

The upcoming report will provide a necessary input to fuel a discussion of the future development.